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DETERMINING THE CATCHES OF CIGARETTE BEETLES  
AND TOBACCO MOTHS MADE IN INSECT TRAPS

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Introduction

In conducting experiments with insect traps for the cigarette beetle and the tobacco moth it was necessary to develop a method of determining the catches of large numbers of these insects. The culmination of the work at the Richmond, Va., laboratory with traps since about 1933 resulted in the perfection of a suction-light trap, which is now being operated in practically all tobacco warehouses during the summer months. Reed et al., 2/ in describing this trap, discussed a satisfactory method of determining catches of the cigarette beetle. In 1940 some seasonal-history studies of the tobacco moth and the cigarette beetle were undertaken with the aid of these traps. The purpose of this paper is to give the details of some improvements in the method of determining the catches of cigarette beetles and to describe a method of determining the catches of tobacco moths.

Description of Apparatus

The equipment necessary for determination of trap catches was as follows:

Anaesthetizing materials.--The insects were killed or rendered inactive before determination of the catch was made. This was accomplished by using a ball of absorbent cotton saturated with chloroform or ether (fig. 1). The cotton ball was made by winding

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1/ The authors are indebted to the following, who have done some work at the Bureau's stored tobacco insect laboratory in Richmond on determining the catches of cigarette beetles and tobacco moths: W. D. Reed, E. M. Livingstone, A. W. Morrill, Jr., and J. P. Vinzant.

2/ Reed, W. D., Morrill, A. W., Jr., and Livingstone, E. M. Trapping Experiments for the Control of the Cigarette Beetle. U. S. Dept. Agr. Circ. 356, 13 pp., illus. 1935.

cord around a small quantity of absorbent cotton in such a manner as to obtain a firm ball about 1-1/2 inches in diameter. A piece of the cord about 6 to 8 inches long was left tied to it, and the ball was suspended in the covered jar containing the insects. The chloroform, or ether, was obtainable at wholesale drug establishments. The technical grade served satisfactorily for this work. These anaesthetics were safe to handle and evaporated cleanly from the glass containers used in trapping and measuring the insects.

Apparatus for separating the insects.--This apparatus consisted of sieves and some large pans for catching the material that sifted through. The sieves were designated numbers 1, 2, and 3. The screen-wire bottom of No. 1 was made of hardware cloth having 8 meshes per inch, with a wire diameter of 0.02 to 0.03 inch. The screen in sieve No. 2 had 12 meshes per inch, with a wire diameter of 0.016 inch; and sieve No. 3 was made with screen having 20 meshes per inch, with a wire diameter of 0.0135 inch. The openings in No. 3 were less than 0.0396 inch in width.

These sieves were made by a local tinsmith. The screen wire of the proper gauge and some circular tin cake pans were purchased from a hardware store. The tinsmith cut out the bottoms of the pans and soldered in the screens. The charge for labor in making these sieves in Richmond, Va., was 50 cents each. The cost of materials for each sieve was about 35 cents. Figure 2 shows the completed set of sieves.

Measuring devices.--For determining large numbers of the insects a volumetric method was developed. The cigarette beetles were measured in a glass graduate calibrated in cubic centimeters. For determining large catches of tobacco moths a glass vial 1 inch in diameter and 3-1/2 inches tall was used. This was calibrated in units of 100 moths, and when properly filled it contained about 800 moths. Figure 3 shows these measuring devices.

#### Determination of Catch

The following procedure was used in obtaining records of the number of tobacco moths and cigarette beetles caught in the traps:

Operation of traps.--The suction-light traps were operated continuously (24 hours per day), and the insects were collected at about 7-day intervals. The glass jar containing the catch was removed, capped, and replaced by a clean jar. The jars were labeled for proper identification as to warehouse or storage section.

Killing or anaesthetizing the catch.--Before the insects were separated and counted, they were killed or anaesthetized by inserting into the jars a ball of absorbent cotton saturated with chloroform and replacing the jar top over the cord attached to the ball (fig. 1). This confined the vapors of the anaesthetic in the

jar and held the cotton ball in suspension. A 10-minute exposure in this manner rendered the insects inactive for a sufficient length of time to determine the catch. Ether may be substituted satisfactorily for chloroform in anaesthetizing the insects.

Separation of insects.--Removal of large moths, beetles, and other insects that were not stored-tobacco pests, but were sometimes caught in the traps, was accomplished by sifting the catch through sieve No. 1. Sifting the catch with sieve No. 2 permitted cigarette beetles and other small insects or fragments to pass through, but separated out the tobacco moths. The moths remaining on the screen of this sieve were emptied into a pan, and the catch was determined by the method described hereinafter. The material that came through sieve No. 2 was placed in sieve No. 3. This sieve permitted the fine material, such as dust, moth scales, fragments of insects, etc., to pass through, but retained the cigarette beetles.

Counting or measuring.--The number of insects present in the catch was determined by actual count or by measuring the volume. When about 100 or fewer tobacco moths were caught, they were counted individually, but if the catch was larger, the number was determined by measure, the glass vial shown at left in figure 3, and previously described, being used for this purpose. The determination of the catch in this manner yielded results that averaged very close to those obtained by actual counting. It was not practical to make an actual count when thousands of insects were caught during one trapping period.

The method of billing the vial was important in obtaining accurate results. It was found that the measuring container held about 800 moths when properly filled. The calibrated device was filled in the following manner: The tobacco moths were concentrated in the receptacle, and the mouth of the vial was passed through the catch of moths, scooping them up. The container was firmly tapped once after each scoop, in order to get the proper density of moths. When the container was filled in this manner, the total was about 800 moths. When the catch was less than 800, the number was determined from the calibrated units of 100 moths.

The number of cigarette beetles was likewise determined by counting when about 100 or fewer were in the catch. If the catch exceeded this number, however, it was determined volumetrically. The beetles were measured in the graduate shown at right in figure 3. As was determined by counting, 1,000 beetles occupied three cubic centimeters. 2/ The total catch was determined by this measure. The beetles were scooped up with the glass graduate in the same manner as described above for moths. After each scoop the graduate was firmly tapped once on a solid surface, which packed the beetles to the proper density.

In a few instances there occurred in the catches large numbers of other species of beetles about the size of the cigarette beetle, and the latter had to be counted. Except in a few instances, however, the method described above proved satisfactory.

After the catch was determined, the moths, beetles, and all other material were burned. It was important to destroy this material to prevent reinfestation of tobacco, since some of the adult insects were in a moribund condition from the effects of the anaesthetic and would revive and escape.



Figure 1.--Apparatus for anaesthetizing insects before determining catches made in suction-light traps. The cotton ball was saturated with chloroform.

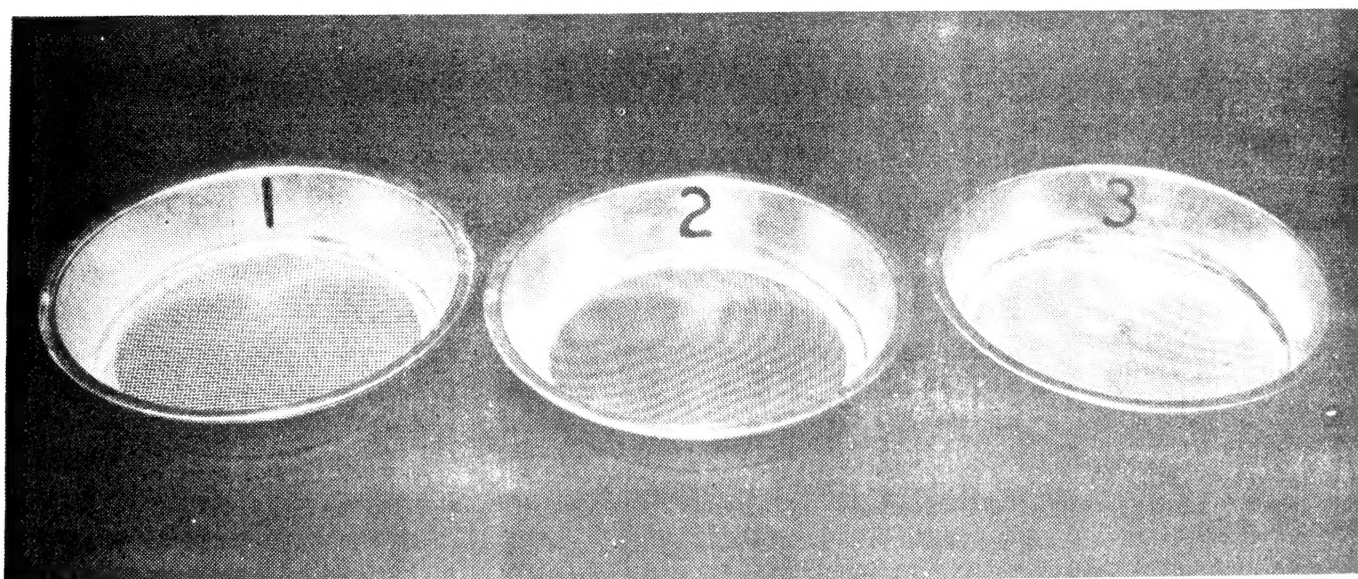


Figure 2.--Sieves used for separating insects caught in suction-light traps. The screen in sieve No. 1 had 8 meshes per inch; in No. 2, 12 meshes per inch; and in No. 3, 20 meshes per inch.



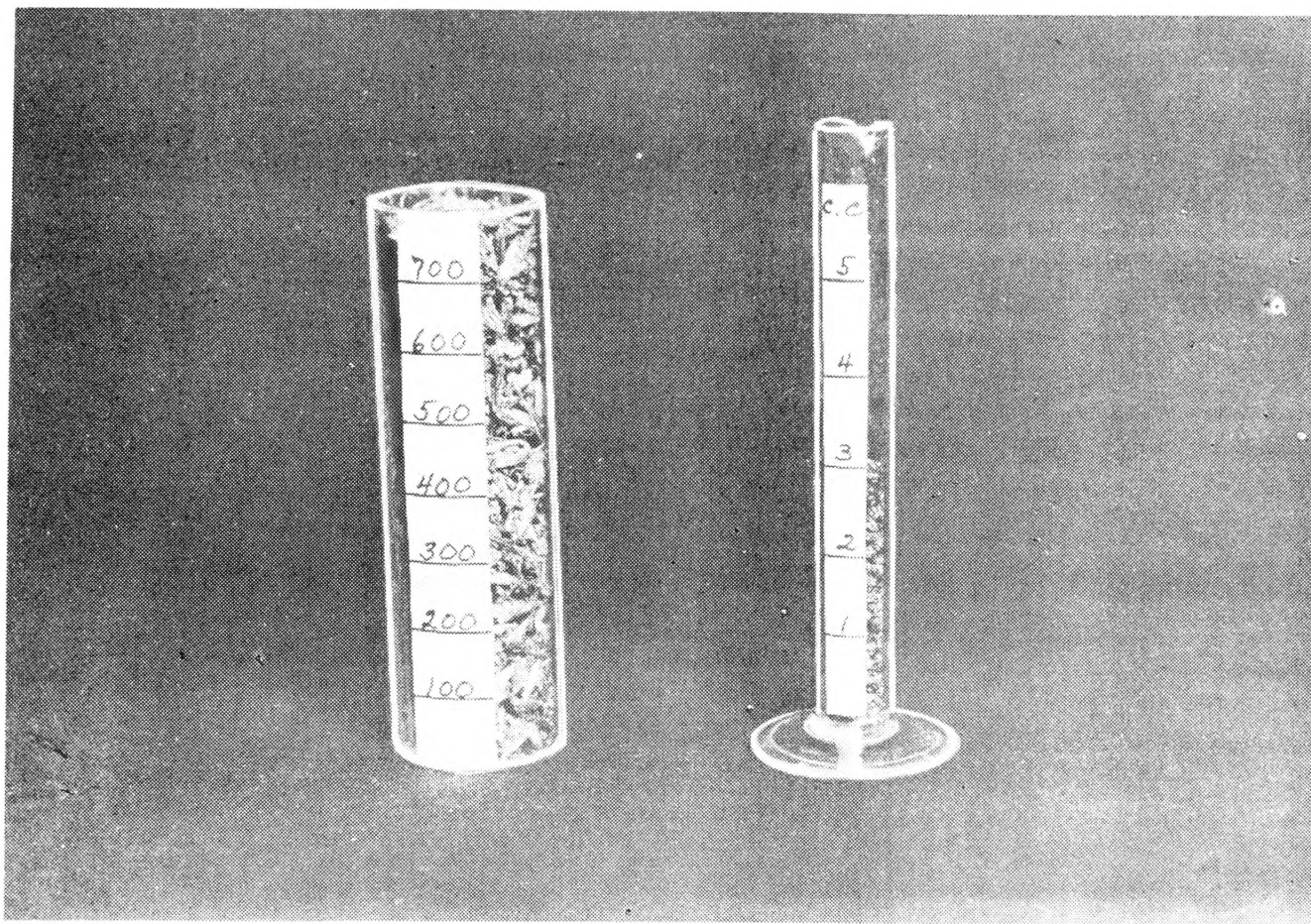


Figure 3.—Calibrated measuring containers used in determining catches of tobacco moths and cigarette beetles from suction-light traps. The container on the left measured tobacco moths, and the one on the right, cigarette beetles.

